Field Analytical Method Infrared Spectrometer (FAMIS)

A Product of the Small Business Innovation Research (SBIR) Program

THE PROBLEM:

The 1990 Clean Air Act Amendment (CAAA) established reduced threshold levels for many product effluent gases from numerous Air Force operations. To avoid penalties, the Air Force must continuously monitor the target gases emanating from its processes and operations.

The low part-per-billion (ppb) threshold levels of the target gases require extremely sensitive instrumentation normally only available in a well-equipped laboratory. The cost of sample collection, chain of custody documentation, and off-site analysis makes on-site, real-time analysis extremely attractive and cost-effective.

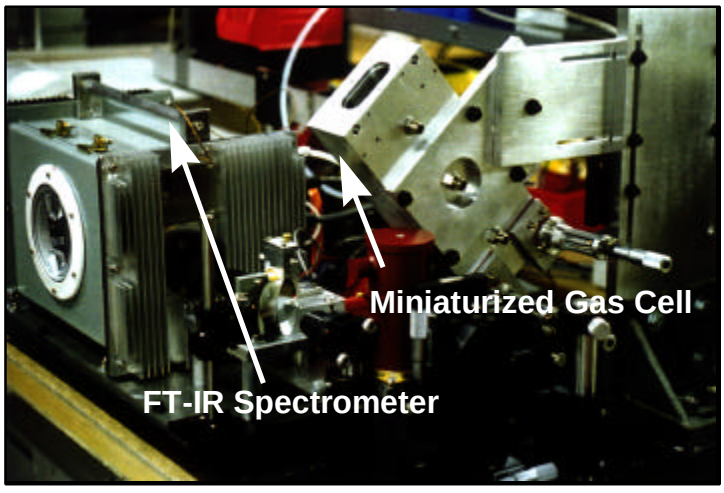
APPROACH:

For many years, use of Fourier Transform InfraRed (FT-IR) spectroscopic analysis in the laboratory has been a preferred method for accurate detection, identification, and concentration measurements of trace gases in effluents. FAMIS will move this technology from the analytical laboratory to the field.

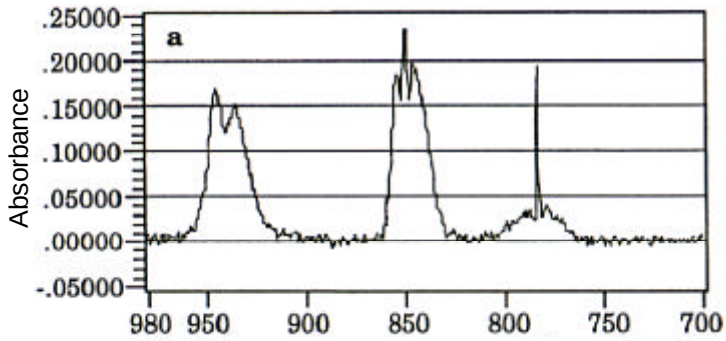
Recent developments in hardware have provided several capable portable FT-IR spectrometers. Previously, the sample gas chamber has been a limiting element to field analysis instrumentation. For efficient ppb analyses, a gas chamber with at least an equivalent 50-meter path length is required. These gas cells have typically required more than 20 liters of gas for each measurement.

THE SOLUTION:

Advanced Fuel Research (AFR), Inc., East Hartford, CT, demonstrated a miniaturized 0.5-liter gas cell measuring 27 cm by 6.4 cm by 11.4 cm. The equivalent long-path length is achieved by reflecting and refocusing the light beam up to 200 times in the gas cell. The miniature cell will have such features as lightweight, modularity, and purge-protected, field-replaceable, self-aligning optics. Miniature cells can be changed in the field for effective path lengths of 5, 20, and 50 meters as dictated by the target gas being measured.



Spectra of 9.8 ppm Trichloroethylene



SENSITIVITY:

The small volume of the FAMIS gas cell is easily charged and purged for measurements, greatly increasing the number of samples processed. The small volume also requires less dilution of small samples to fill the gas cell, resulting in more representative readings. Assessments to the ppm level will be possible in 10 seconds, while assessments to the ppb level will be possible in 3 minutes.

PAYOFF:

The FAMIS will provide a transportable device to make rapid, accurate determinations of mixed gas-phase contamination levels. The payoff to the Air Force is significantly reduced cost for obtaining each data point over the current sampling and off-site analysis method. FAMIS is expected to perform three times more analyses per day, require less calibration time (due to its greater ruggedness), and need less operator training than current methods. Easier, less costly sampling and analysis are conducive to more frequent sampling and avoidance of possible fines for violation of the CAAA.

COMMERCIALIZATION:

AFR, Inc. has entered into an agreement with On-Line Technologies, Inc., for commercialization and distribution of FAMIS. On-Line Technologies is a spin-off company of previous AFR participation in the SBIR program. On-Line Technologies manufactures a state-of-the-art FT-IR with the ruggedness, portability, scan speed, and overall performance needed for this application.

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